

## **WHAT IS CLAIMED IS:**

1. A PAPR (peak to average power ratio) reduction method using bit reallocation, applied in a multi-carrier system, the transmitter of the multi-carrier system transmitting D-bit data at N sub-carriers over a channel,  
5 the method comprising the steps of:
  - an initializing step, for initializing a bit loading algorithm to allocate  $d_i$  bits required at the i-th sub-carrier for data transmission, wherein  $0 \leq i \leq (N - 1)$ ;
  - a PAPR computing step, for computing the PAPR of the  
10 multi-carrier system in accordance with  $d_i$  bits transmitted at the i-th sub-carrier;
  - a comparing step, for determining if the PAPR is larger than a predetermined value A, and if yes, terminating the process; and
  - a adjusting step, for performing an adjustment of increasing  $\Delta d$  bits  
15 at a first selected sub-carrier and decreasing  $\Delta d$  bits from a second selected sub-carrier, and then executing the PAPR computing step.
2. The method as claimed in claim 1, wherein the multi-carrier system is an orthogonal frequency division multiplexing (OFDM) system.
3. The method as claimed in claim 1, wherein the bit loading  
20 algorithm can be any bit loading algorithm and any adaptive bit loading algorithm.
4. The method as claimed in claim 1, wherein the bit loading algorithm applies Campello's second bit loading algorithm.
5. The method as claimed in claim 4, wherein the initializing step

includes the steps of:

a distributing step, for equally distributing D bits around all sub-carriers such that the i-th sub-carrier carries  $d_i = \frac{D}{N}$  bits, wherein

$$D = \sum_{i=0}^{N-1} d_i, \text{ for } 0 \leq i \leq (N - 1);$$

5 a first smallest selecting step, by comparing the power increment at all sub-carries, each of which is increased by  $\Delta d$  bits, for selecting an m-th sub-carrier with the smallest power increment  $\Delta P_m$  among all sub-carriers, wherein  $m = \arg[\min_{0 \leq i \leq N-1} \Delta P_i(d_i + \Delta d_i)]$ ;

10 a first largest selecting step, by comparing the power decrement at all sub-carries, each of which is decreased by  $\Delta d$  bits, for selecting an n-th sub-carrier with the largest power decrement  $\Delta P_n$  among all sub-carriers it, wherein  $n = \arg[\max_{0 \leq i \leq N-1} \Delta P_i(d_i)]$ ;

a comparing step, for comparing whether the power increment  $\Delta P_m$  is less than the power decrement  $\Delta P_n$ , and if yes, executing the next step;

15 and

a first adjusting step, for increasing  $\Delta d$  bits to the m-th sub-carrier and decreasing  $\Delta d$  bits to the n-th sub-carrier.

6. The method as claimed in claim 5, wherein the first smallest selecting step and the first largest selecting step can be exchanged or  
20 merged into one step in the process.

7. The method as claimed in claim 1, wherein the adjusting step includes the steps of:

a second smallest selecting step, by comparing the power increment at all sub-carries, each of which is increased by  $\Delta d$  bits, for selecting an  $x$ -th sub-carrier as a first sub-carrier with the smallest power increment  $\Delta P_x$  among all sub-carriers, wherein  $x = \arg[\min_{0 \leq i \leq N-1} \Delta P_i(d_i + \Delta d_i)]$ ;

5 a second largest selecting step, by comparing the power decrement at all sub-carries, each of which is decreased by  $\Delta d$  bits, for selecting a  $y$ -th sub-carrier as a second sub-carrier with the largest power decrement  $\Delta P_y$ , among all sub-carriers, wherein  $y = \arg[\max_{0 \leq i \leq N-1} \Delta P_i(d_i)]$ ; and

10 a second adjusting step, for increasing  $\Delta d$  bits to the  $x$ -th sub-carrier and decreasing  $\Delta d$  bits to the  $y$ -th sub-carrier.

8. The method as claimed in claim 7, wherein the second smallest selecting step and the second largest selecting step can be exchanged or merged into one step in the process.

9. The method as claimed in claim 1, wherein the adjusting step 15 includes the following steps of:

a third smallest selecting step, by comparing the power increment at all sub-carries, each of which is increased by  $\Delta d$  bits, for selecting first  $M$  sub-carriers with first  $M$  smallest power increment, among all sub-carriers, wherein  $M \leq N$ ;

20 a third largest selecting step, by comparing the power decrement at all sub-carries, each of which is decreased by  $\Delta d$  bits, for selecting first  $M$  sub-carriers with first  $M$  largest power decrement among all sub-carriers; and

a third adjusting step, for increasing  $\Delta d$  bits to one of the  $M$

sub-carriers with the first M smallest power increment and decreasing  $\Delta d$  bits to one of the M sub-carriers with the first M largest power decrement.

10. The method as claimed in claim 9, wherein the third smallest selecting step and the third largest selecting step can be exchanged or merged into  
5 one step in the process.

11. The method as claimed in claim 1, further comprising an iteration comparing step, which determines if the number of iteration is less than a predetermined maximal number of iteration L, and if yes, executing the adjusting step.

10 12. The method as claimed in claim 1, wherein the PAPR is computed by an inverse fast Fourier transform (IFFT) algorithm.

13. The method as claimed in claim 1, wherein after the adjusting step, the transmitter of the multi-carrier system transmits the side information about the bit reallocation to the receiver through the original N  
15 sub-carriers over the original channel or through another method over an additional channel.

14. The method as claimed in claim 13, wherein when the transmitter of the multi-carrier system transmits the side information, a side information protector protects the side information.

20 15. The method as claimed in claim 14, wherein the side information protector applies an error correction code to protect the side information.